

Are Australian jobs becoming more skill-intensive? Evidence from the HILDA dataset

Doug Fraser

Australian Innovation Research Centre, University of Tasmania

Abstract

Labour market policy rhetoric since the 1980s has promoted the view that jobs in industrialised countries, if they are to survive the pressures of global competition, will need to place ever-increasing demands on the skills of the workforce. This paper describes a study designed to test this proposition on a representative sample of the Australian working population over the period from 2001 to 2005. The data come from HILDA (Household, Income and Labour Dynamics in Australia), a panel survey of some 6,000 households and 18,000 individuals conducted annually since 2001. The dataset includes three indicators representing a common metric across industries, occupations and levels in the workforce hierarchy of the degree to which jobs “stretch” the skill base of those who work in them, together with three variables covering task discretion and worker autonomy, which past research has shown to be highly correlated with skill-intensity. These data make it possible for the first time to duplicate in Australia, albeit in lesser detail, the landmark research on the skills trajectory of the UK economy carried out over the last twenty years for the Economic and Social Research Council. Initial analyses suggest that in the aggregate, Australian jobs were *less* skill-intensive in 2005 than in 2001, a counter-intuitive trend for which an explanation has still to be found.

Introduction

This paper describes the research model and initial findings of a study of statistical evidence on changes in the skill-intensity of jobs across the Australian economy from 2001 to 2005. It thus contributes to an understanding of the skills trajectory of the Australian economy, albeit in a phase that was not representative of its course over the preceding half-century and may not be replicated in coming decades. This period was marked by the rapid emergence of skill shortages in several key sectors and the onset of full employment to a degree unprecedented in over three decades. Precisely for that reason, however, the developments of this half-decade put the skilling system under a level of stress which has arguably exposed many of its key strategic vulnerabilities.

Quantitative research of this nature was not feasible for Australia until very recently because of the absence of longitudinal data employing a common metric to track skill requirements across all industries and all levels of the workforce. This contrasts with the situation in the UK where such data have been systematically collected for over twenty years. The gap has now been filled, at least in part, by a set of variables in HILDA (Household, Income and Labour Dynamics in Australia), a longitudinal panel survey based on a rigorously constructed sample of approximately 6,000 Australian households (18-20,000 individuals) and jointly managed by the Commonwealth Department of Families, Housing, Communities and Indigenous Affairs and the Melbourne University Institute for Applied Economic and Social Research. Five annual waves of data are now available from HILDA, with a sixth expected to be available by the time this paper is presented.

This combination of sample size and currency allows very precise micro-analysis of trends in the utilisation of skill, while providing a large range of promising independent variables (social, employment-related and attitudinal) to explain them. Among the questions that can potentially be addressed using this source are:

- whether the overall skill level of Australian jobs is rising, across the board or differentially;
- how the changing structure of Australian industry is affecting skill requirements, and skill utilisation, in different industries;
- how the demand for skill is distributed across levels in the occupational/ qualifications hierarchy, and whether this distribution is changing over time;
- the effect, if any, which a tight labour market has had on the skill content of jobs;
- how closely the incidence of work-based or employer-supported training corresponds to actual needs for increased skill;
- the extent, if any, to which employers are recruiting or developing skills which they do not subsequently put to effective use; and
- how embodied knowledge flows between industries, and particularly from industries generally regarded as skill-intensive to those seen as lower-skilled, through labour mobility.

Research context

This research forms part of a broader project to develop the concept of a national skilling system and map its workings in Australia. Derived from models of innovation systems developed in the innovation literature (Freeman, 1987; Lundvall, 2007; Malerba, 2005; Asheim and Gertler, 2005), the national skilling system concept also continues a tradition of VET theory dating back to the seminal work of Keep and Mayhew (1988) and Finegold and Soskice (1988) which attributed the UK's relative disadvantage in workforce skills to "system failure", as opposed to just failures on the supply side. It also draws on the "Varieties of Capitalism" literature (Hall and Soskice, 2001) and parallel research in evolutionary economics (Lazonick and O'Sullivan, 1994; Lam, 2005; Gertler, 2005) focused on the role of relatively durable social and economic institutions in enabling and constraining the response of firms in different nations to economic opportunities and challenges. It builds on earlier constructs of the skills equilibrium (Finegold and Soskice, 1988) and the skill ecosystem (Finegold, 1999; Buchanan, 2006), being essentially a macro-scale manifestation of the latter.

The skilling system approach views the input of skill to the economy, not as a simple matter of supply, but as the product of a dynamic reciprocal interaction between the three key mechanisms of *supply*, *demand* and *utilisation* or *deployment*. It sees these interactions as ultimately deriving, not from adventitious events or the conscious strategic decisions of economic actors (individual or collective), but from a nation's economic and social institutions. Thus, for example, the supply of skills is driven not just by the activity of the training system, but by factors influencing the decisions of workers and labour market entrants to follow a given career path, by the mechanisms that enable skilled labour to flow to the jobs that will use it most productively, by the opportunities workers have to develop and update their skills in the course of their work, and by the incentives they have to remain in jobs that make use of their training (Richardson, 2007); demand is determined, among other factors, by the types of productive investment which the nation's physical endowments and economic policy settings encourage; and the effective deployment of skill in workplaces depends on product strategy and work organisation, which in turn relate to such factors as industry culture, managerial capabilities, the nature of the employment contract and the

industrial relations laws. Both demand and deployment adjust, generally in an incomplete and lagged manner, to variations in supply, as well as the reverse.

Thus, in contrast to more commonly used terms like “VET system” and “skill formation system”, which refer not to a system in the strict technical sense but simply to a complex of institutions and infrastructures on the supply side of the market for skills, this model presupposes a true systems dynamic between these three processes, covering both sides of the market and characterised by non-hierarchical interactions and feedback loops. It thus represents a useful corrective, not only to the supply-side focus which dominates Australian VET research, but to the expectation commonly voiced by policymakers that skill formation can and should be driven purely by the current expressed demand of existing employers.

The function of the national skilling system is to ensure that an optimal quantum and mix of skills is converted into productivity across the economy at any point in time. Note that this is a different matter from either creating or deploying the highest achievable volume or level of skills; the mix of high, intermediate and low skills across the full range of technical domains must be appropriate to current firm capabilities and market opportunities if the maximum achievable productivity is to be attained, and hence must evolve continuously.

This evolving nature of the optimum means that the output of the skilling system is best measured as a *flow*, whereas most attempts so far to measure it have tried to establish the *stock* of skills in the economy. The concept of a stock is of limited practical value because a skill, once formed, does not become a permanent feature of the economy: it decays if not used, it can be (and often needs to be) developed and adapted through learning-by-doing on the job and through the creation of new knowledge in the work process, and it ultimately becomes obsolete or loses its relevance. These lifecycle effects are reinforced by the unavoidable lag which occurs between demand-side signals and supply-side response, at any rate where formal skills are concerned, meaning that demand and supply for any given skill exist in a constant state of dynamic imbalance.

The appropriate term to describe such an evolving phenomenon is a skill *trajectory* (Hogarth and Wilson, 2003). The origins of this term are unclear and its definition remains imprecise, but it refers broadly to the direction in which the skills mix of an economic unit is moving over a given period of time. As used by Hogarth and Wilson, the concept is scale-independent and can be applied at any level of generality, from an individual through to an entire national or world economy. At the level of the national system, the two key questions relating to the skills trajectory are:

1. To what extent do workers in different industries and occupations need to exercise skill in their job, and how is this changing over time?
2. Which skills are increasing, and which declining, in their importance to the economy?

The present research focuses on the first of these questions.

The data

HILDA, reflecting its origins as a data source for the former Department of Social Security, was designed to collect data on a wide range of matters affecting individual and family welfare, including employment history, reliance on transfer payments and other non-wage income, family formation and functioning, gender roles, mental and physical health, and a

variety of attitudes toward life and social issues. The survey instrument consists of three parts, a household questionnaire and a questionnaire for each individual in the household over the age of 15, which are administered face-to-face by an interviewer, and a self-completion questionnaire which is left with the individual respondents after the interview to fill out in their own time and submit by mail. The self-completion questionnaire includes items of a sensitive nature (e.g. job security, quality of family relationships) which the respondent might be reluctant to discuss in the presence of other household members. The data from all three questionnaires are combined in a single file for each wave, and can be linked at the individual respondent level through a unique identifier which is retained across successive waves.

The six key variables¹ used in this analysis are drawn from the self-completion questionnaire. The first set of three relates to the skill requirements of the respondent's main job:

- COMPLEX (_jomcd) - My job is complex and difficult (waves 1-5)
- NUSKILLS (_jomns) - My job often requires me to learn new skills (1-5)
- USESKILL (_jomus) - I use many of my skills and abilities in my current job (1-5)

The second set refers to task discretion, which is hypothesised on the evidence of past research overseas (Spenner, 1990: 402) to correlate strongly with skilfulness:

- OWNTASK (_jomfd) - I have a lot of freedom to decide how I do my job (waves 1-5)
- HAVESAY (_jomls) - I have a lot of say about what happens in my job (1-5)
- WORKFLOW (_jomfw) - I have a lot of freedom to decide when I do my work (1-4)

Two further variables in each wave refer to the level of work stress experienced by the respondent. Responses to all these questions are recorded on a 7-point Likert scale. Each question attracts approximately 6-7,000 valid responses in each wave.

In addition to the above, which will be used primarily as dependent variables, the dataset offers a wide choice of items with high face validity as independent variables, including employment history, educational attainment, fields of qualification, industry and occupation of main job, length of time in current employment, and incidence of job-related training. Individual waves also cover special topics, providing a basis for cross-sectional analysis against the normal dependent variables for the year concerned. For example, Wave 5 contains six additional variables relating to job quality (repetitiveness, variety, speed of work, opportunities to take initiative) and a large set of data on respondents' values and attitudes which could be used to test industry claims (e.g. ACCI, 2007) about the demand for attitudinal "skills" by comparing the responses against aspects of each respondent's work history.

Precedent research

As noted above, researchers in the UK have been working for over twenty years on this kind of analysis, using five surveys conducted at roughly 5-year intervals between 1986 and 2006 by the Economic and Social Research Council (ESRC), an academic body which is independent of government, though the surveys have received government funding. These are household surveys of employed adults, with an achieved sample of around 4,500

¹ The first label for each variable (capitalised) is an intuitively meaningful one coined for the purposes of this analysis. The second (lower case) is that used in the source file. The underscore refers to an identifying character, currently a-e, designating the wave in which each variable was recorded, e.g. ejomcd for Wave 5).

individuals in the 2006 round. Their focus is much narrower than that of HILDA, directed mostly at issues of work, skill and remuneration, but within their compass they generally provide far richer data. They were not originally planned as a coherent series and draw a new sample for each run. However, later surveys have generally built on previous ones to preserve data continuity while progressively increasing the breadth and depth of the dataset (Felstead, Gallie and Green, 2002; Felstead, Gallie, Green and Zhou, 2007).

Like HILDA, the ESRC surveys collect data in the two broad areas of job complexity and task discretion. The data they record on job complexity are considerably more extensive than those in HILDA, but the questions on task discretion are sufficiently similar to permit fairly reliable comparison. The indicators in each of these areas have been combined into an index, based on principal component analysis, and these indices rather than the constituent variables are used as the dependent or analysis variables, as required, in most of the published analyses.

Over the period 1986-2006 these surveys have tracked a steady rise in the requirement for skill across most jobs, though growth slowed after 2001. This was primarily apparent in a growing requirement for formal qualifications at all levels, though this is counterbalanced by evidence of possible credentialism (Felstead et al, 2002: 11), especially at lower levels in the qualifications framework where the policies of successive governments have favoured a rapid expansion of formal certification, mostly through RPL, in jobs previously treated as unskilled (Keep, Mayhew and Payne, 2006). However, the trend has been apparent in more robust indicators such as training time and the amount of time required in a job to learn to do it properly. A particularly interesting indicator is the need to keep learning new skills on the job; this is in fact the only key indicator not to have plateaued since 2001. These latter trends are seen as marking a growing role for learning in the workplace as opposed to formal training (Felstead et al, 2007: x).

In general, the skill requirement has risen broadly in line with occupational hierarchy, meaning that the relativities between different levels have changed little. In particular, there is little evidence of progress in meeting the need for a major expansion of middle-level skills that was identified by the NIESR matched case-study research in the 1980s and 90s (Steedman, Mason and Wagner, 1991). While most generic skills appear to be increasingly required, the only ones to carry a significant wage premium across the board are computer skills and the category of higher-level communication and planning skills characterised as “influencing skills”.

On the negative side, despite growing indications that workers expect to use skill and initiative in their jobs, the task discretion index showed a strong decline up to 2001, though the decline has since levelled off. It was most pronounced for professionals, possibly reflecting the fashion for managerialist forms of work organisation that continued throughout the 1990s.

The HILDA data offer scope for replicating many of these analyses, albeit sometimes in much less detail and with less reliability. In particular, they are far less informative on the actual skill content of respondents’ jobs, meaning that any change in the need for particular skill types (technical or generic) can only be derived obliquely from more complex analyses, e.g. through tracking wage trajectories or the relative incidence of unemployment for individuals who hold relevant qualifications. More importantly, the short total timeframe covered so far by HILDA makes direct comparison extremely problematic, since longer-term trends that are clearly statistically significant over twenty years are much less likely to become apparent over

five. It will be difficult if not impossible to locate any trends that do emerge from the Australian data in the same historical context as the British findings, given the complete absence of directly comparable data for the period before 2001. In compensation, the more frequent refresh rate of the data and the far greater diversity of available explanatory variables, taken together with the focus on a specific period in the history of the Australian labour market where there is strong consensus on the major factors influencing its performance, offer much greater scope for theory-based analyses. Given that any trends identified will have emerged within recent memory, there is also greater scope for triangulating the findings with follow-up qualitative research. A final and decisive advantage of HILDA is that as a panel survey, it allows tracking of individuals' skill and employment trajectories over time.

Methodological issues

(a) measuring skill

The chief problem in designing an exercise such as this, which seeks to track movements in skill requirements across the economy, is to find a common metric for skill which is "blind" to the location of a job or an employee, either in a given industry or at a given level in the workforce hierarchy. Comparison between skill categories is difficult because different skills have largely incommensurable knowledge content: there is no obvious common unit by which the quantum of skill exercised by a banker can be measured against that exercised by a jeweller. Skill is also commonly agreed to be a multidimensional concept (Spenner, 1990), in that there are many different ways of classifying skill (generic/specific, manual/cognitive/behavioural, hard/soft, platform/terminal, transferable/situated) depending on the purpose for which the distinction is drawn. A further element of concern, prominent in the sociological literature, is the socially constructed element of skill – the view that judgements about which jobs are skilled, or which are more skilled than others, owe at least as much to social convention and the relative bargaining power of different occupational interest groups as they do to variation in some intrinsic content of difficulty (Attewell, 1990)².

In the past, the stock of skills in the economy was generally measured through conveniently available proxies – principally level of qualification or years of schooling in the case of skills held by individuals, and occupational classification in the case of skills required to perform a job. The first of these kinds of proxy is unsatisfactory precisely because it assumes away many of the issues which are legitimate subjects of this kind of analysis, notably the possibility of worker-job mismatches resulting from credentialism or skill underutilisation, the quality of match between skills taught and skills exercised in the workplace, and the relative contributions of formal training or study and job-based learning to occupational competence (Borghans et al, 2001: 375). The second type is especially vulnerable to social construction, and also fails to provide adequately either for change over time in the skill content of the same occupation, or for the possibility that part of a worker's existing skill base is transferred and transformed when s/he moves to a different occupation. As a matter of

² This aspect is further complicated by an expansion over time in the broad definition of skill. Many recent authors (e.g. Grugulis, Warhurst and Keep, 2004) draw attention to an increasing focus on attitudinal, presentational and emotional "skills" of a kind that would have been regarded in earlier times as either personal attributes or aspects of workplace culture. Borghans et al point out (2001: 376) that the "unskilled" worker of a generation ago needed characteristics like strength, stamina and fortitude which would equally have had to count as skills had the same definition applied then.

good research method, it seems preferable to develop one or more distinctive variables to capture skill in its own right, leaving such secondary indicators available as analysis variables.

Spenner (1990: 402), reviewing his own and others' research up to the end of the 1980s, suggested that a satisfactory proportion of the relevant variance in job skill requirements was captured by just two dimensions which could be applied in a conceptually consistent way to a wide range of disparate jobs:

- *Substantive complexity*: the level, scope and integration of mental, manipulative and interpersonal tasks in a job;
- *Autonomy-control*: the discretion or leeway available in a job to control the content, manner and speed with which tasks are done.

He reported high levels of correlation between these two variables ($r = .5^0-.7^0$) in empirical studies. Both dimensions could be captured adequately by worker self-report, which in turn had been shown to provide reliable data on the substantive complexity dimension in studies where an independent job analysis by expert raters was available for comparison. Self-report has the added advantage of capturing the actual characteristics of the individual job as experienced by the individual working in it, rather than some notional standardised job description. Much subsequent research, including the present study, has followed this model.

Measuring the substantive complexity dimension is nevertheless problematic. A major difficulty is that it can easily confuse job complexity (the need to coordinate many skilled operations) with work intensification (the need to carry out many different and possibly unrelated operations, some or all of which may be individually low-skilled, in a limited time)³. Felstead et al (2002: 25), in their account of the British research on which this study is modelled, describe a strategy based on triangulation. Respondents were asked, firstly, what level of qualification would be necessary to get their present job if it were filled today; secondly, how much training they had needed to learn it; thirdly, how long it had taken them on the job to learn to do it well; and fourthly, to indicate which of a list of generic operations, intended as indicators of broad platform skills, their job required them to carry out.

HILDA, as has been seen, is much less comprehensive in its approach to job complexity. In effect, the relevant HILDA variables track the growth and decay of skill in workplaces, a metric that is appropriate to a flow model but would be less so if the intent, as in the British research, were to measure the stock. It should be understood, however, that these data tell nothing about the actual amount of skill in each job, even supposing that to be quantifiable; for instance, "learning new skills" probably demands on average a great deal more application, prior knowledge and underlying aptitude for a surgeon than it does for a low-level clerk. They capture the *prevalence* of skill (which can be conceptually compared across widely differing occupations) rather than the *degree* of skill (which cannot easily be).

Hence, the appropriate term for the construct measured is *skill-intensity* rather than *skill*. A sector is classified as "skill-intensive" if a high proportion of its workers find that their skill base is stretched by their job and needs to be continually upgraded, regardless of whether that skill base would be considered high in its own right. This construct would be of limited usefulness in purely cross-sectional analyses, given the variation in its objective meaning

³ As explained below, this problem appears to be pronounced for the one indicator of job complexity in HILDA.

from one industry and occupation to the next, but comes into its own where the purpose of the analysis is to track *movements* in skill requirement over time across the full spectrum of jobs.

It should also be borne in mind that these variables actually measure the *match* between the worker and the job, rather than the objective skill-intensity of the job. This too is appropriate in an analysis of flow, since any mismatch that persists beyond a short transitional period is bound to have dynamic consequences. On the negative side, where neither the employing firm nor the employee can adjust to ensure that the currently unused skills are put to good use (static mismatch), these skills will eventually decay and cease to be available to the worker, the employing firm or the broader economy. In a more positive construction (dynamic mismatch), even skills and knowledge that are currently under-utilised can add to the firm's absorptive capacity (Cohen and Levinthal, 1990), providing it with the capability to adopt new processes or move into new product areas. Asking questions about match probably also provides more reliable and comparable data, since respondents are more likely both to assess and to report the distance between their competence and the requirements of the job accurately than either their own skill levels or the skill demands of the job.

(b) interpreting Likert scale data

While change on individual variables can be tracked readily from wave to wave by comparing mean scores for the panel, this procedure is methodologically questionable because it is appropriate to interval or ratio data, and should strictly not be applied to ordinal data like response scales where the interval between adjacent ratings cannot be presumed to be constant either across the full rating scale, or between respondents. On the other hand, medians, the accepted measure of central tendency for ordinal data, do not discriminate sufficiently to capture the expected amount of change over such a short period because of the limited number of points on the scale (HAVESAY is the only variable to show any variance in the aggregate median rating over the first five waves).

It could be argued that the normal objections to the use of the mean do not apply with the same force so long as the analysis is confined to an aggregated comparison of individual respondents' scores for the same item over time, since each individual's perception of the distance between adjacent scores can be assumed to remain relatively constant over such a short period as five years; i.e. insofar as error results from differences in individuals' assessment of the distance between scores, this error should remain more or less constant from one wave to the next. However, this argument does not address the problem that the same respondent may apply unequal distances between different ratings on the scale for the same item.

This in turn raises one of the most intractable problems with odd-numbered Likert-type scales: the ambiguity attaching to the mid-scale rating. Where no opt-out response category ("Don't know", "Not applicable") is provided, the central rating becomes a dumping-ground for a variety of non-standard and noncommittal responses: not just "Can't make up my mind one way or the other", but "not sufficiently interested to form an opinion", "don't know enough to judge", "question makes no sense to me", "I've got strong views both ways, they sort of balance out", etc. By treating all central responses as valid scores, one runs the risk of skewing the analysis by overestimating the true neutral response.

A rating towards the middle of the scale may also reflect indifference, as respondents should logically be less inclined to give an extreme rating to an issue that lacks salience for them.

Hence, a flattening of the distribution curve could be evidence of changes in employees' views about the importance of exercising skill. Conversely, any growth in salience of the issue could lead to a greater incidence of socially desirable response bias, though this could be expected to concentrate in "marginally agree/disagree" or "moderately agree/disagree" ratings in the absence of firm respondent perceptions of actual change.

At this stage in the study a conservative approach has been taken to this problem. Only the two scores at either end of the scale (≥ 6 , ≤ 2) are treated as agreement/disagreement for analysis purposes. Although it means losing a certain amount of valid data, this approach at least minimises the risk of false positives, while still providing a measure sufficiently discriminating to reveal changes from year to year which are not strong enough to change the median. To the extent that a more or less peaked distribution of scores indicates a genuine shift in the salience of the issue for the respondents, this approach captures such effects where the mean or median might not.

Initial analyses and findings

Frequency counts across the five waves show a small but significant decline in the percentage of "agree" responses on all variables for both skill-intensity and task discretion from 2002 onwards (Figures 1 and 2). After an initial sharp drop-off of between two and five percentage points from 2001, the curves mostly flatten out until 2004, with some recovery apparent in COMPLEX, NUSKILLS and HAVESAY for 2005. In no case, though, does the percentage return to the 2001 level. Broadly speaking, the indicators for skill-intensity and task discretion move in the same direction, with the former generally receiving greater agreement. Respondents across all waves express the most positive perceptions of the opportunity their work gives them to exercise their skills (median = 6), and are least positive about the level of control they have over when they do their work (median = 3). Broadly similar trends appear on all variables in mean scores and when the threshold for "agree" is lowered to 5, suggesting that the relatively tough criterion for agreement does not distort the direction of movements in the data.

That said, the trends at first sight appear counter-intuitive. One might expect that where employers have difficulty recruiting suitable skilled labour, they would be more creative and demanding in the use of their present enterprise skill base, which would include trying to expand their employees' competence to cover for kinds of labour which are currently difficult to recruit. Yet the data suggest on the surface that in the aggregate at least, jobs became *less* demanding in these regards over the three years when the labour market tightened fastest. Equally, one would expect existing skilled employees to be worked harder (if not necessarily smarter) to cover for vacancies that cannot be filled, yet the cross-wave variables which come closest to capturing work intensification, namely the questions on job stress, show a parallel decline that continues through to 2005⁴.

⁴ It should be noted that these two questions involve very strongly worded statements. The less extreme of the two, "My job is more stressful than I had ever imagined" (median score all waves = 3) might better be interpreted as an indicator of unexpected *increase* in stress.

Figure 1
Trends in skill-intensity 2001-05 (% respondents rating item ≥ 6)

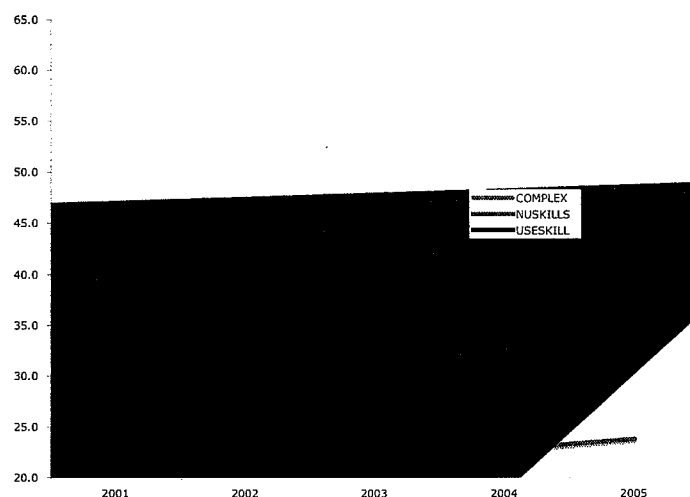


Figure 2
Trends in task discretion 2001-05 (% respondents rating item ≥ 6)



One possible explanation is that the skills shortages of the early 2000s, despite their high public visibility, affected only limited sections of the labour market and their impact on aggregate trends was not sufficient to offset other influences applying in less pressured areas. Another is that these trends could simply reflect a longer-term downward trajectory which may even have been temporarily slowed by the tightening of the labour market. In either case, the implications for Australia's economic future are serious. Alternatively, and perhaps less alarmingly, they may simply reflect a lag in industry's response to the new labour market situation. The apparent pickup on several indicators in 2005 is especially interesting in the light of these possibilities, and the figures for Wave 6 will be critical to determining whether it represents a reversal of the earlier decline and perhaps even a return to longer-term upward trend (though they will still leave the turndown unexplained).

Because these findings will strongly influence the direction of further research, detailed longitudinal analysis will take place only after the Wave 6 data become available in February.

In the meantime, a number of exploratory cross-sectional analyses on individual waves have shed some light on the possibilities for further analysis.

As already noted, the Wave 5 questionnaire contained a number of supplementary questions which provide more detail on aspects of job quality, including two directly relating to work intensification. The responses to these questions provided an opportunity to seek more clarity on the exact implications of COMPLEX as respondents perceived it. Regressing COMPLEX against USESKILL and six other variables relating to job variety, repetitiveness, opportunity to exercise initiative, stress, work-intensity and time pressure, the strongest predictors were found to be stress ($\beta = .290$) and work-intensity ($\beta = .232$). While all predictors were significant at the .01 level, the strongest of the predictors relating to skilfulness, USESKILL, returned a β of only .149. Stress also emerged as by far the strongest predictor (.385) when the analysis was repeated for the Wave 4 data, using USESKILL, OWNTASK AND HAVESAY as the other independent variables. Thus, the analysis confirms the suspicions raised earlier that this variable is more likely to reflect perceptions of work-intensification than it is to capture the concept of substantive complexity as understood by Spenner and measured in the UK research. Given the view of many scholars that work-intensification and skill-intensification represent alternative and contrasting paths to greater competitiveness and productivity, this ambiguity seriously curtails the value of the data for comparative research.

Further linear regressions were carried out on the Wave 4 data using each of the three skill-intensity indicators in turn as the dependent variable, with a constant set of independent variables covering occupation, industry of employment and time in current job. This was undertaken in the light of promising Pearson correlations between the dependent variables and recent job change. Around 20% of the panel in each wave reported a change in either occupation or employer in the last 12 months, a figure that appears high by comparison with some of the figures in the ABS 2006 Labour Mobility publication. However, the only independent variable to show a respectable β on all three regressions was occupation, with the job-change variables failing to reach statistical significance in most cases. The best of these regressions explains only around 30% of the variance.

Conclusion

At this point in the study, the findings should be treated as work in progress rather than a reliable contribution to knowledge in the field. The primary purpose of the paper has been to introduce the data source and give a flavour of the kinds of evidence it provides and the insights that it can potentially support as the analysis proceeds. More comprehensive and rigorously validated findings should be available by the middle of 2008.

HILDA is uniquely valuable in that it currently provides the only high-quality source of quantitative evidence on the dynamics of skill use across the whole of Australian industry. Compared with the British Skills Surveys, it offers distinctive advantages for developing a "flows" model of the output of the national skilling system, notably in its use of a panel sample which allows individual respondents' skill trajectories to be tracked over time, and by using indicators which primarily capture the growth and decay of skill in the workplace. The breadth of its scope allows developments in skill use to be linked back to a wide range of factors which might not be intuitively obvious or identifiable from purely economic data sources. It should be acknowledged that these advantages are largely fortuitous, since HILDA represents a found object so far as this researcher is concerned.

Even at an early stage of descriptive analysis, the data provide interesting, largely counter-intuitive and potentially disturbing indications of what is happening in the labour market. They suggest strongly that far from a greater willingness emerging on the part of industry to address new economic challenges by building on the skills of its workforce, many firms may still be locked into a relatively low-skill path even in circumstances of full employment. The fact that several of the key indicators have shown a downward trend, at a time when Australia faces unprecedented challenges to develop new and distinctive sources of comparative advantage, gives rise for concern that the stresses of a tight labour market may actually have sent perverse signals to business.

REFERENCES

ABS (2006) *Labour Mobility*, Cat. No. 6209.0 (reissue)

ACCI (2007) *Skills for a Nation: A Blueprint for Improving Education and Training 2007-2017*, Executive summary

Asheim B and Gertler M, The Geography of Innovation: Regional Innovation Systems, in Fagerberg, Mowery and Nelson, Eds., *The Oxford Handbook of Innovation*, Oxford UP: 291-317

Attewell P (1990) What Is Skill?, *Work and Occupations* 17(4): 422-448

Borghans E, Green F, Keep E (2001) Skills measurement and economic analysis: an introduction, *Oxford Economic Papers* 3: 375-384

Buchanan J (2006) *From 'skill shortages' to decent work: the role of better skill ecosystems*, Sydney, NSW Board of Vocational Education and Training

Cohen W and Levinthal D (1990) Absorptive Capacity: A New Perspective on Learning and Innovation, *Administrative Science Quarterly* 35: 128-152

Felstead A, Gallie G, Green F (2002) *Work Skills in Britain 1986-2001*. Downloadable from www.skopc.ox.ac.uk

Felstead A, Gallie G, Green F and Zhou, Y (2007) *Skills at Work, 1986 to 2006*. Downloadable from www.skopc.ox.ac.uk

Finegold D (1999) Creating self-sustaining, high-skill ecosystems, *Oxford Review of Economic Policy* 15(1): 60-81

- and Soskice, D (1988) The Failure of Training in Britain: Analysis and Prescription, *Oxford Review of Economic Policy* 4(3): 21-53

Freeman, C (1987) *Technology Policy and Economic Performance: Lessons from Japan*. London, Pinter

Gertler M (2005) *Manufacturing Culture: The Institutional Geography of Industrial Practice*. Oxford UP

Grugulis I, Warhurst C, Keep E (2004) What's Happening to 'Skill'?, in Warhurst C, Grugulis I, Keep E (Eds) *The Skills that Matter*, Basingstoke, Macmillan Palgrave

Hall, P and Soskice D (2001) *Varieties of Capitalism*. Oxford UP

Keep E and Mayhew K (1988): The Assessment: Education, Training and Economic Performance, *Oxford Review of Economic Policy*, 4(3): i-xv

Keep E, Mayhew K, Payne J (2006) From skills revolution to productivity miracle - not as easy as it sounds?, *Oxford Review of Economic Policy* 22(4): 539-559

Lam A (2005) Organizational Innovation, *Oxford Handbook of Innovation*: 115-147

Lazonick W and O'Sullivan M (1994) *Skill formation in wealthy nations: Organizational evolution and economic consequences*. Oslo, STEP

Lundvall, B A (2007) National Systems of Innovation – Analytical Concept and Development Tool, *Industry and Innovation* 14(1): 95-119

Malerba F (2005) Sectoral Systems of Innovation, *Oxford Handbook of Innovation*: 380-406

Richardson S (2007) *What is a skill shortage?*, Adelaide, NCVER

Spenner K (1990) Skill; meanings, methods and measures, *Work and Occupations* 17(4): 399-421

Steedman H, Mason G, Wagner K (1991) Intermediate Skills in the Workplace: Deployment, Standards and Supply in Britain, France and Germany, *National Institute Economic Review* 136 (60): 60-76

Wilson R, Hogarth T (2003): *Tackling the low skills equilibrium*. Final report, UK Department of Trade and Industry (available at www.skope.ox.ac.uk).

(Submitted January 2008)